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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Applicant: Cha	Art Unit: 2177
Serial No.: 09/512,949	Examiner: Pannala
Filed: February 25, 2000	**AM9-99-0217**
For: **INDEXING SYSTEM AND METHOD FOR NEAREST NEIGHBOR SEARCHES IN HIGH DIMENSIONAL DATA SPACES**	October 22, 2005 750 B STREET, Suite 3120 San Diego, CA 92101

FOURTH SUPPLEMENTAL APPEAL BRIEF

Commissioner of Patents and Trademarks
Washington, DC 20231

Dear Sir:

This fourth supplemental appeal brief is in response to the Order Returning Undocketed Appeal to Examiner, alleging that the third supplemental appeal brief failed to include a "Summary of the Claimed Subject Matter", a "Claims appendix", an "evidence appendix", and a "related proceedings appendix". In fact, the brief contained a "Summary of the Invention" that summarized each independent claim complete with references to the specification, as well as an appendix listing the claims, albeit under differently-worded headings than the ones used in the Order. Accordingly, Appellant can only assume that it was the wording of the headings that are being complained of, and herewith submits a new brief with the headings demanded by the Board, as well as blank appendices for evidence and related proceedings.

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(1) Real Party in Interest

The real party in interest is IBM Corp.

(2) Related Appeals/Interferences

No other appeals or interferences exist which relate to the present application or appeal.

(3) Status of Claims

Claims 1-24 are pending and more than twice rejected.

(4) Status of Amendments

No amendments are outstanding.

(5) Summary of Claimed Subject Matter

As an initial matter, it is noted that according to the Patent Office, the concise explanations under this section are for Board convenience, and do not supersede what the claims actually state, 69 Fed. Reg. 155 (August 2004), see page 49976. Accordingly, nothing in this Section should be construed as an estoppel that limits the actual claim language.

As set forth in Claim 1 and disclosed on page 3, penultimate paragraph, the invention is a computer (reference numeral 18, page 5, line 18, Figure 1) programmed to query for data (page 5, line 18). For data vectors (reference "p", Figures 3 and 4, page 7, lines 19 and 20) in a data space (Figures 2 and 3, page 7, lines 8-14), respective approximations (Figure 2, block 32, page 7, lines 21 and 22) are generated in polar coordinates (Figure 2, block 32, page 7, lines 21 and 22), and then based on the approximations, "k" nearest neighbors to the query are returned (page 3, lines 13-15; page 4, lines 7 and 8; page 5, line 22 to page 6, line 1).

The reference numerals and page citations above are incorporated herein. Claim 8 recites a computer program product including a program of instructions having computer readable code means for generating approximations (Figure 2, block 32, page 7, lines 21 and 22) including local polar coordinates (Figure 2, block 32, page 7, lines 21 and 22) of at least some data vectors **p** in at least one data set having a dimensionality of "d". The local polar coordinates are independent of "d". Computer readable code means use the approximations to return "k" nearest neighbors to a query (page 3, lines 13-15; page 4, lines 7 and 8; page 5, line 22 to page 6, line 1).

The reference numerals and page citations above are incorporated herein. Claim 15 recites a computer-implemented method for finding, in a data space, "k" closest data vectors **p** (page 3, lines 13-15;

page 4, lines 7 and 8; page 5, line 22 to page 6, line 1) to a query vector **q**. The method includes rendering approximations of at least some of the data vectors **p** using local polar coordinates (Figure 2, block 32, page 7, lines 21 and 22), and filtering the approximations. After filtering, the "k" closest data vectors **p** are returned (page 3, lines 13-15; page 4, lines 7 and 8; page 5, line 22 to page 6, line 1).

(6) Grounds of Rejection to be Reviewed on Appeal

(a) Claims 8-14 and 23 have been rejected under 35 U.S.C. §101 as reciting non-statutory subject matter.

(b) Claims 1-4, 8-12, 15-18, and 22-24 have been rejected under 35 U.S.C. §103 as being unpatentable over Fayyad et al. (USPN 6,263,334) in view of the Oregon University paper.

(c) Claims 5-7, 13, 14, and 19-21 have been rejected under 35 U.S.C. §103 as being unpatentable over Fayyad et al. (USPN 6,263,334) in view of the Oregon University paper, and further in view of Staats (USPN 5,619,717).

(7) Argument

As an initial matter, it is noted that according to the Patent Office, a new ground of rejection in an examiner's answer should be "rare", and should be levied only in response to such things as newly presented arguments by Applicant or to address a claim that the examiner previously failed to address, 69 Fed. Reg. 155 (August 2004), see, e.g., pages 49963 and 49980. Furthermore, a new ground of rejection must be

approved by the Technology Center Director or designee and in any case must come accompanied with the initials of the conferees of the appeal conference, id., page 49979.

So here's an interesting test of the principles propounded by the Patent Office to the public in the Federal Register. This case was remanded by the Board to the examiner at the behest of the Group Director, evidently for a quality control (QC) check. What did that remand accomplish? A pick up of a "defect" in the Declaration, noticing that one of the inventors added "Korea" to his address and disapprovingly citing MPEP §602.01 for the proposition that the Declaration can't be changed. It can't - ***after the inventor has signed it***, just like MPEP §602.01 says. Here, the "alteration" - the addition of words to the inventor's address - (1) is not material, and (2) in any case clearly is in the inventor's own handwriting, as a cursory comparison with the date next to his signature reveals. Certainly, there is no evidence that the Declaration was tampered with after signing, much less in any material way.

There appear to be two substantive changes in the rejections resulting from the remand. The first is that a computer program product including a program of instructions having computer readable code means for doing something as set forth in Claim 8 is not statutory, citing three cases from before the modern computer era as well as State Street Bank. It appears to be the examiner's position that a "computer program product" is not a "computer readable medium". On such pin heads do angels dance.

MPEP §2106(IV)(B)(2)(a) defines a "Statutory ***Product*** Claim" (the MPEP's words, as well as the expression used in Claim 8) in terms of a "manufacture" which is "the ***production*** of" an article from a material that gives the material a new form, quality, property, etc. (emphasis mine). What is a "product" if not that? Why does the MPEP approve of a "product" claim but Claim 8 is non-statutory for claiming a "product"? Appellant notes that QC remains opaque as to how it would like to see Claim 8 characterized,

a perplexing position for a QC check to take particularly when, as here, the claim uses identical language to that which is approved of in the MPEP. Appellant, after reading the above-cited portion of the MPEP, remains baffled as to what is desired for a finding of statutory subject matter, but remains open to productive good faith suggestions.

The second thing of substance to evolve out of the QC check is the replacement of one secondary reference showing polar coordinates (Apple Computer) with another (Oregon Univ.), neither of which have anything to do with querying. Consequently, what remains unanswered, even after QC, is Appellant's previous point, namely, that while Appellant is fully aware of transformations between coordinate systems, that fact in a vacuum does not suggest altering the explicit teaching of Fayyad et al. to use Cartesian coordinates.

Specifically, the entire thrust of Fayyad et al.'s querying system is cast in column 8 in terms of "Euclidean distance". None of the equations on which Fayyad et al. is based would work in polar coordinates. Indeed, no proffer of why a reasonable expectation of success exists in converting Fayyad et al.'s invention to polar has been made, contrary to the requirements of MPEP §2142. This is perhaps not surprising, because Fayyad et al. would appear to require wholesale modification if it were to depart from its Cartesian coordinate scheme.

As it is, simply converting Fayyad et al.'s Cartesian system to polar would destroy the efficacy of its equations to execute nearest neighbor searches, thereby rendering the proposed modification deficient under MPEP §2143.01 (citing In re Gordon). For example, consider the disclosure in Fayyad et al., col. 8, lines 14-25:

> "Use of a Euclidean weighted distance measure does not change the results other than a pre-scaling of the input space...[t]he use of a weighting factor allows certain dimensions of the *n* attributes to be favored or emphasized."

Thus, it is important to the Fayyad et al. invention that a Euclidean weighting factor (and concomitantly Cartesian coordinates) be used to discriminate among attributes, as taught by Fayyad et al. But, how this desired feature might be achieved were Fayyad et al. converted to polar coordinates is anyone's guess. Certainly, if anything Fayyad et al.'s emphasis on the advantages of its disclosed Cartesian coordinate system, coupled with its absolute silence on any other coordinate system, would hardly motivate one to modify Fayyad et al. to use polar coordinates. Accordingly, the rejection, which simply observes that one can convert from Cartesian to polar coordinates without identifying any prior art reason to do so in the context of data querying, continues the tradition of the present prosecution in failing to establish a prima facie case of obviousness, and should be reversed.

Claims 5-7, 13, 14, and 19-21 have been rejected under 35 U.S.C. §103 as being unpatentable over Fayyad et al. and Oregon Univ. in view of Staats, another patent in which the word "polar" nowhere appears. The suggestion to toss Staat into the mix finds no support in the prior art, but only in what the Examiner believes are Staat's advantages, in a vacuum.

While during examination "the name of the game is the claim", that had better not be the name of the game in establishing a *prima facie* case of obviousness; otherwise, impermissible hindsight reconstruction is implicated. The "name of the game" here is finding a ***prior art*** suggestion to combine references independently of Appellant's own teachings. This simply has not been done. No affirmative suggestion appears in Fayyad et al. to use polar coordinates, even though it is a safe bet that Mr. Fayyad was aware of

them. Indeed, as analyzed above, very real reasons exist against using polar coordinates. The rejections beg for reversal.

Respectfully submitted,

John L. Rogitz
Registration No. 33,549
Attorney of Record
750 B Street, Suite 3120
San Diego, CA 92101
Telephone: (619) 338-8075

JLR:jg

CLAIMS APPENDIX (A)

1. A computer programmed to undertake method acts for querying for data using a query, the method acts undertaken by the computer including:

for at least some data vectors in a data space, generating respective approximations in polar coordinates; and

based on the approximations, returning "k" nearest neighbors to the query.

2. The computer of Claim 1, wherein the method acts further comprise:

dividing the data space into plural cells; and

representing at least one data point in at least one cell in polar coordinates with respect to the at least one cell.

3. The computer of Claim 2, wherein the data space has "d" dimensions and the method acts further comprise:

determining a number of "b" bits to be assigned to each cell; and

dividing the data space into 2^{bd} cells.

4. The computer of Claim 1, wherein each approximation defines a lower bound d_{min}, and the method acts further comprise:

generating a candidate set of approximations based at least on the lower bounds d_{min} of the approximations.

5. The computer of Claim 4, wherein the query can be represented by a query vector **q**, and the method acts further comprise:

adding a first approximation having a first lower bound d_{min1} to the candidate set if d_{min1} < k-NN^{dist} (q), wherein k-NN^{dist} (q) is the k^{th} largest distance between the query vector **q** and nearest neighbor vectors **p**.

6. The computer of Claim 5, wherein the method acts further comprise using the candidate set to return "k" nearest neighbors vectors **p** to the query vector **q**.

7. The computer of Claim 6, wherein not all vectors **p** corresponding to approximations in the candidate set are examined to return the "k" nearest neighbors.

8. A computer program product including a program of instructions having:

computer readable code means for generating approximations including local polar coordinates of at least some data vectors **p** in at least one data set having a dimensionality of "d", the local polar coordinates being independent of "d"; and

computer readable code means for using the approximations to return "k" nearest neighbors to a query.

9. The computer program product of Claim 8, wherein the means for generating generates respective approximations of data vectors **p** in local polar coordinates.

10. The computer program product of Claim 9, further comprising:
computer readable code means for dividing the data space into plural cells; and
computer readable code means for representing each approximation in polar coordinates with respect to one of the cells.

11. The computer program product of Claim 10, wherein the data space has "d" dimensions, further comprising:
computer readable code means for determining a number of "b" bits to be assigned to each cell; and
computer readable code means for dividing the data space into 2^{bd} cells.

12. The computer program product of Claim 9, wherein each approximation defines a lower bound d_{min} and an upper bound d_{max}, and the product further comprises:
computer readable code means for generating a candidate set of approximations based at least on the lower bounds d_{min} and upper bounds d_{max} of the approximations.

13. The computer program product of Claim 12, further comprising:
computer readable code means for adding a first approximation having a first lower bound d_{min1} to the candidate set if d_{min1} < k-NN^{dist} (**q**), wherein k-NN^{dist} (**q**) is the k^{th} largest distance between the query vector **q** and nearest neighbor vectors **p** associated with approximations in the candidate set.

14. The computer program product of Claim 13, further comprising computer readable code means for using the candidate set to return "k" nearest neighbors vectors **p** to the query vector **q**.

15. A computer-implemented method for finding, in a data space, "k" closest data vectors **p** to a query vector **q**, comprising:
rendering approximations of at least some of the data vectors **p** using local polar coordinates;
filtering the approximations; and
after filtering, returning the "k" closest data vectors **p**.

16. The method of Claim 15, further comprising:
dividing the data space into plural cells; and
representing each approximation in polar coordinates with respect to one of the cells.

17. The method of Claim 16, wherein the data space has "d" dimensions and the method further comprises:

determining a number of "b" bits to be assigned to each cell; and
dividing the data space into 2^{bd} cells.

18. The method of Claim 15, wherein each approximation defines a lower bound d_{min}, and the method further comprises:

generating a candidate set of approximations based at least on the lower bounds d_{min} of the approximations.

19. The method of Claim 18, further comprising:

adding a first approximation having a first lower bound d_{min1} to the candidate set if d_{min1} < k-NN^{dist} (q), wherein k-NN^{dist} (q) is the k^{th} largest distance between the query vector **q** and nearest neighbor vectors **p** associated with approximations in the candidate set.

20. The method of Claim 19, further comprising using the candidate set to return "k" nearest neighbors vectors **p** to the query vector **q**.

21. The method of Claim 20, wherein not all data vectors **p** corresponding to approximations in the candidate set are examined to return the "k" nearest neighbors vectors **p**.

22. The computer of Claim 4, wherein each approximation defines an upper bound d_{max}, and the method acts further comprise:

generating a candidate set of approximations based at least on the upper bounds d_{max} of the approximations.

23. The computer program product of Claim 12, wherein each approximation defines an upper bound d_{max}, and the product further comprises:

computer readable code means for generating a candidate set of approximations based at least on the upper bounds d_{max} of the approximations.

24. The computer of Claim 1, wherein each approximation defines an upper bound d_{max}, and the method acts further comprise:

generating a candidate set of approximations based at least on the upper bounds d_{max} of the approximations.

EVIDENCE APPENDIX (B)

None.

RELATED PROCEEDINGS APPENDIX (C)

None.